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Armed Forces College of Medicine

AFCM

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DEVELOPMENT OF HEAD AND NECK 2

[DEVELOPMENT OF THE FACE]

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INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1. Identify the 5 facial prominences or facial primordia and their contribution to the face.
2. Discuss changes in the frontonasal prominence.
3. Comment on the intermaxillary segment & list its derivatives.
4. Describe the changes in maxillary prominences.
5. Give a note on the changes in mandibular prominences.
6. Discuss the development of the palate.
7. Explain the congenital anomalies of the face.

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Lecture Plan



1. Part 1 (5 min) Introduction
2. Part 2 (40 min) Main lecture
3. Part 3 (5 min) Summary

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Key points



1. The 5 facial prominences or primordia & their fate
2. Changes in the frontonasal prominence (FNP)
3. Changes in the maxillary prominence
4. Changes in the mandibular prominence
5. Development of the palate
6. Congenital anomalies of the face

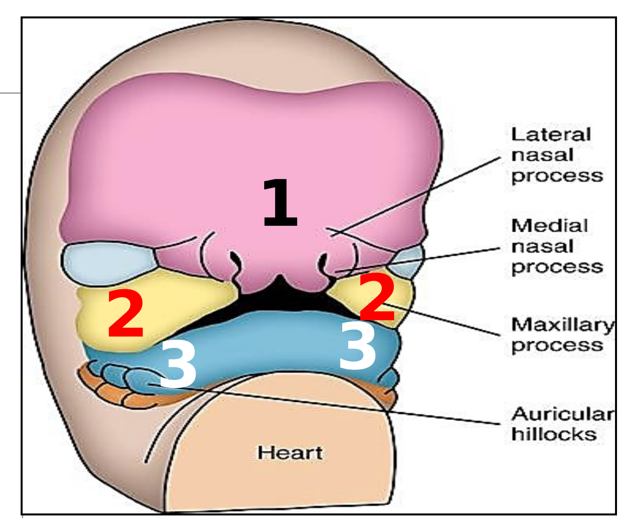
♣ During the 4th week, 5 facial prominences (primordia) appear around the stomodeum (primitive mouth) Under the inductive effect of 2 <u>mesodermal</u> organizing centers; (located ventral to the forebrain & hindbrain), They include:

1.A <u>single</u> frontonasal prominence (FNP). *Ventral to forebrain*

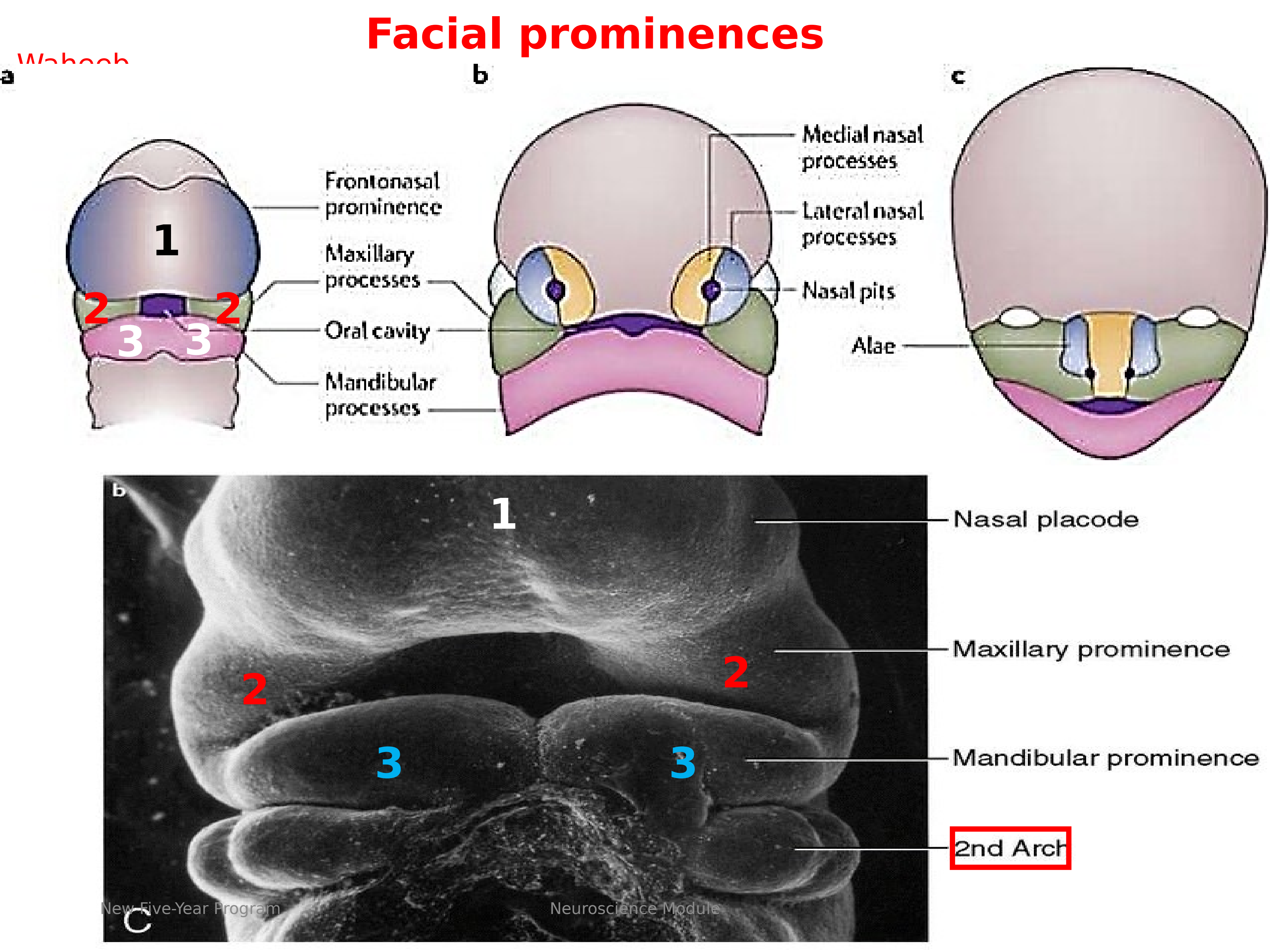
2.Paired maxillary prominences.

3.Paired mandibular prominences.

-Both maxillary & mandibular prominences are derived from



♣All the 5 prominences are produced by <u>neural crest cells</u> that migrate into the pharyngeal arches during 4th week of development.


Facial prominences
a
1
2
2
3
3
Frontonasal prominence
Maxillary processes
Oral cavity
Mandibular processes
b
Medial nasal processes
Lateral nasal processes
Nasal pits
c
Alae
b
1
2
2
3
3
Nasal placode
Maxillary prominence
Mandibular prominence
2nd Arch
C
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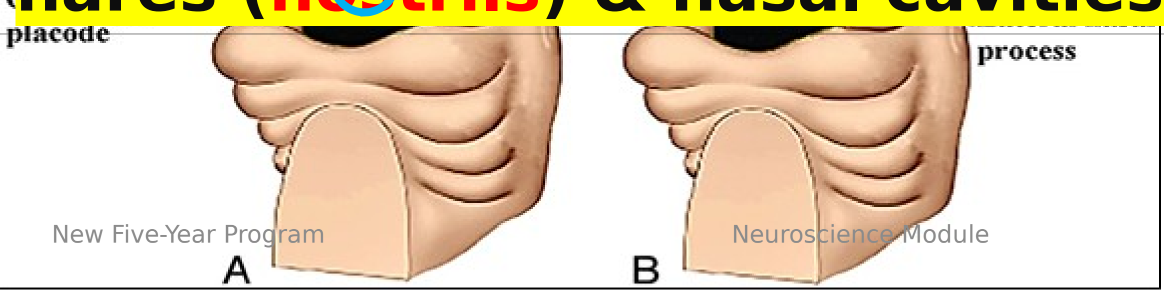
A]Changes in the frontonasal prominence (FNP):

.By the end of 4th week, bilateral oval thickenings of the surface ectoderm (nasal placodes) appear on inferolateral parts of FNP.

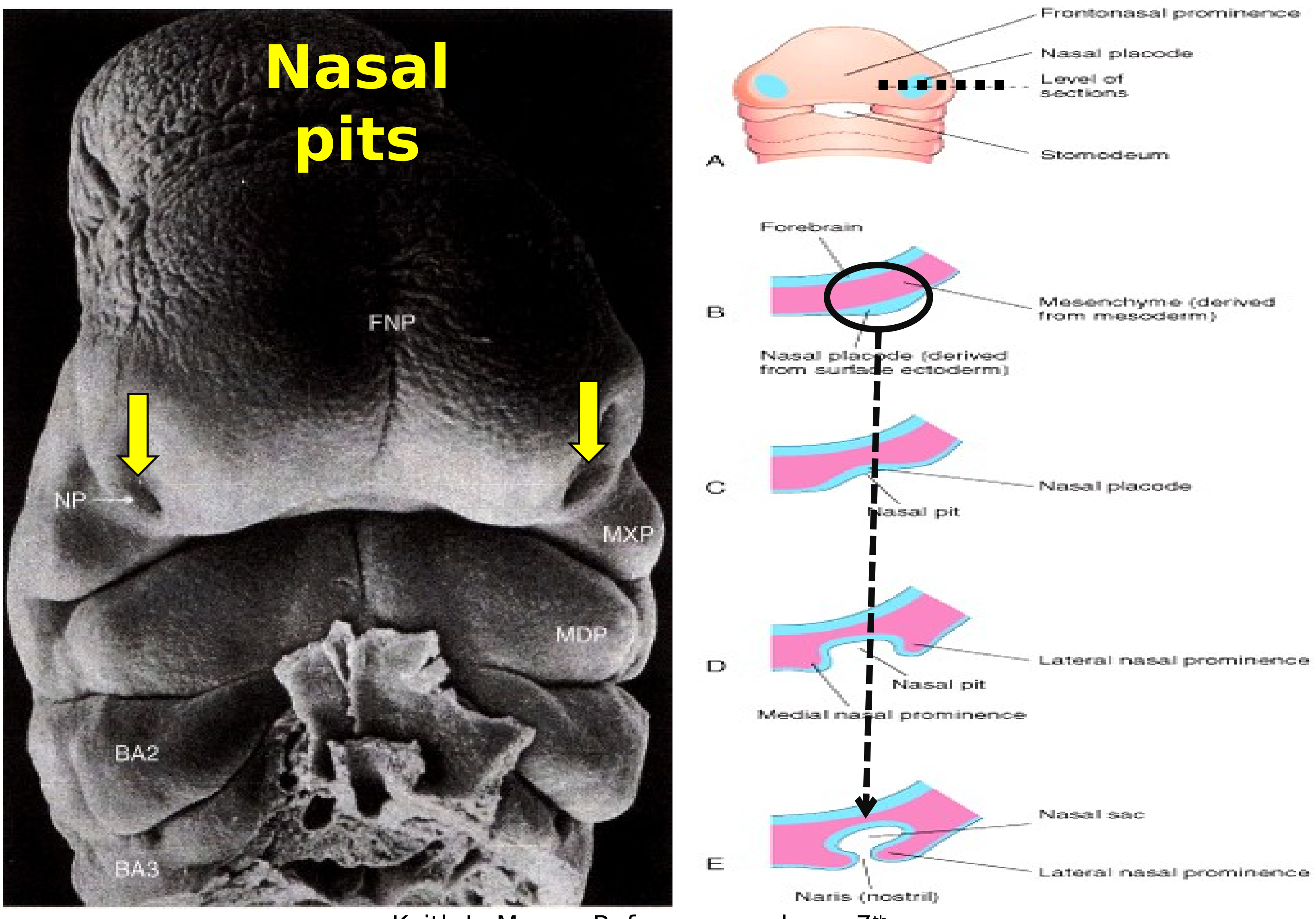
.Nasal placodes are depressed to form nasal pits ⇒ Nasal sacs.

.The mesenchyme in the margins of nasal placodes proliferates, producing horseshoe-shaped elevations (medial & lateral nasal prominences) which surround the nasal pits.

.Nasal pits are the primordia of the anterior nares (nostrils) & nasal cavities.

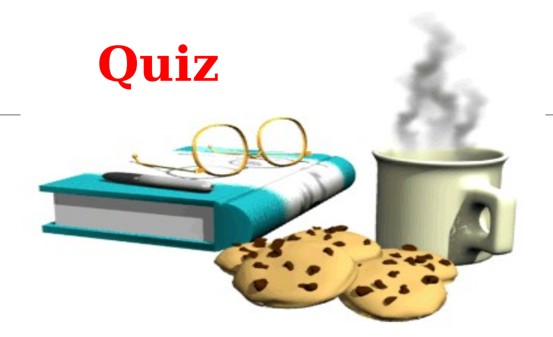


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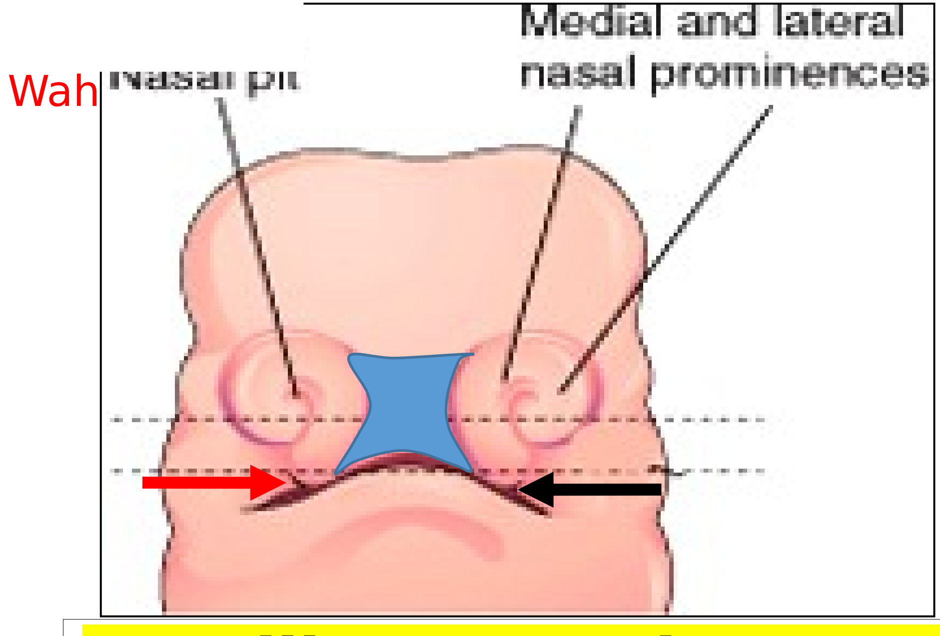
Keith L. Moore: Before we are born, 7th edition

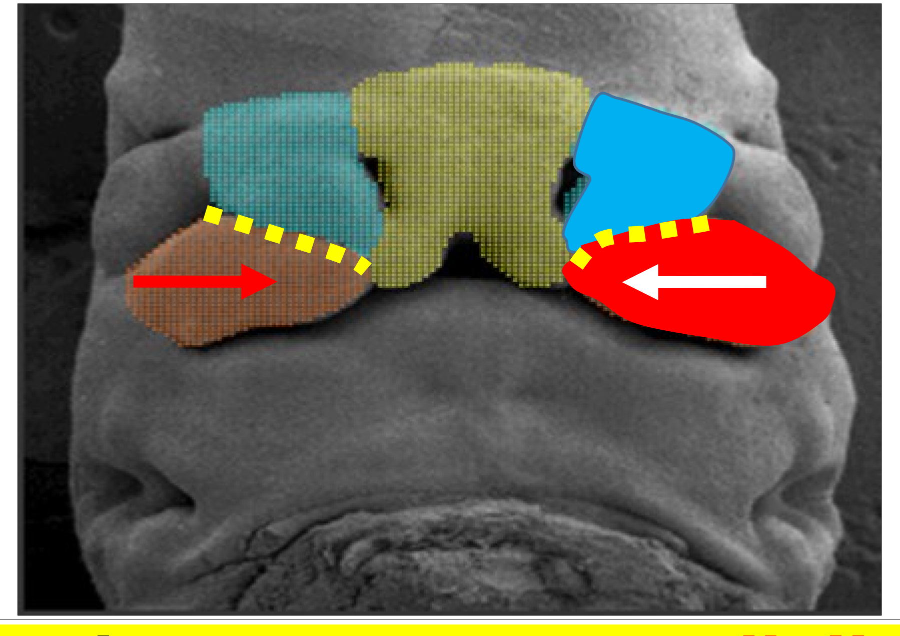
Quiz



- What is the main inducer for development of facial prominences?
- Enumerate the 5 facial primordia
- What is the fate of the FNP

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.Maxillary prominences enlarge & grow medially toward each other ⇒ Push medial nasal prominences toward the median plane & each other.

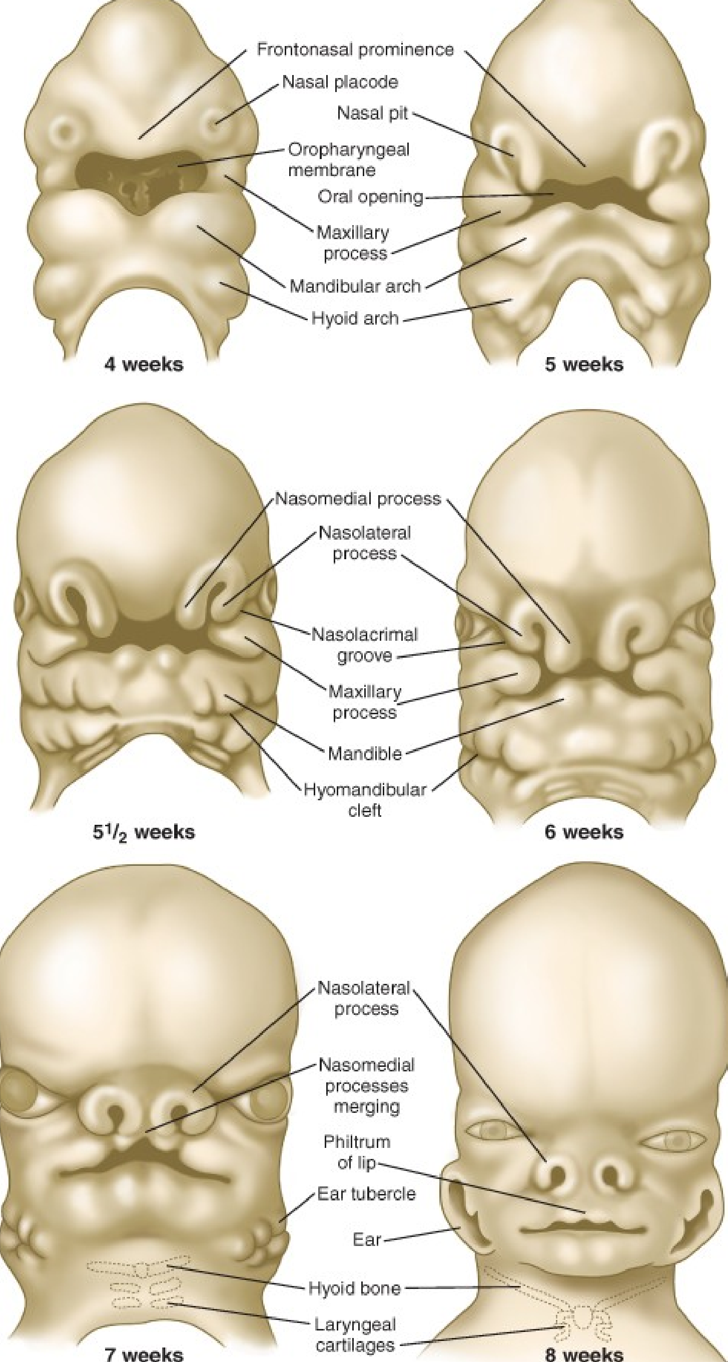
-The 2 medial nasal prominences fuse together in median plane to form a median nasal prominence (intermaxillary segment).

.Each lateral nasal prominence:

- fuse with the ipsilateral side of median nasal prominence ⇒ Formation of anterior nares.

-separated from the maxillary prominence

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Frontonasal prominence
Nasal placode
Nasal pit
Oropharyngeal membrane
Oral opening
Maxillary process
Mandibular arch
Hyoid arch
4 weeks
5 weeks
Nasomedial process
Nasolateral process
Nasolacrimal groove
Maxillary process
Mandible
Hyomandibular cleft
$5^1/_2$ weeks
6 weeks
Nasolateral process
Nasomedial processes merging
Philtrum of lip
Ear tubercle
Ear
Hyoid bone
Laryngeal cartilages
7 weeks
8 weeks

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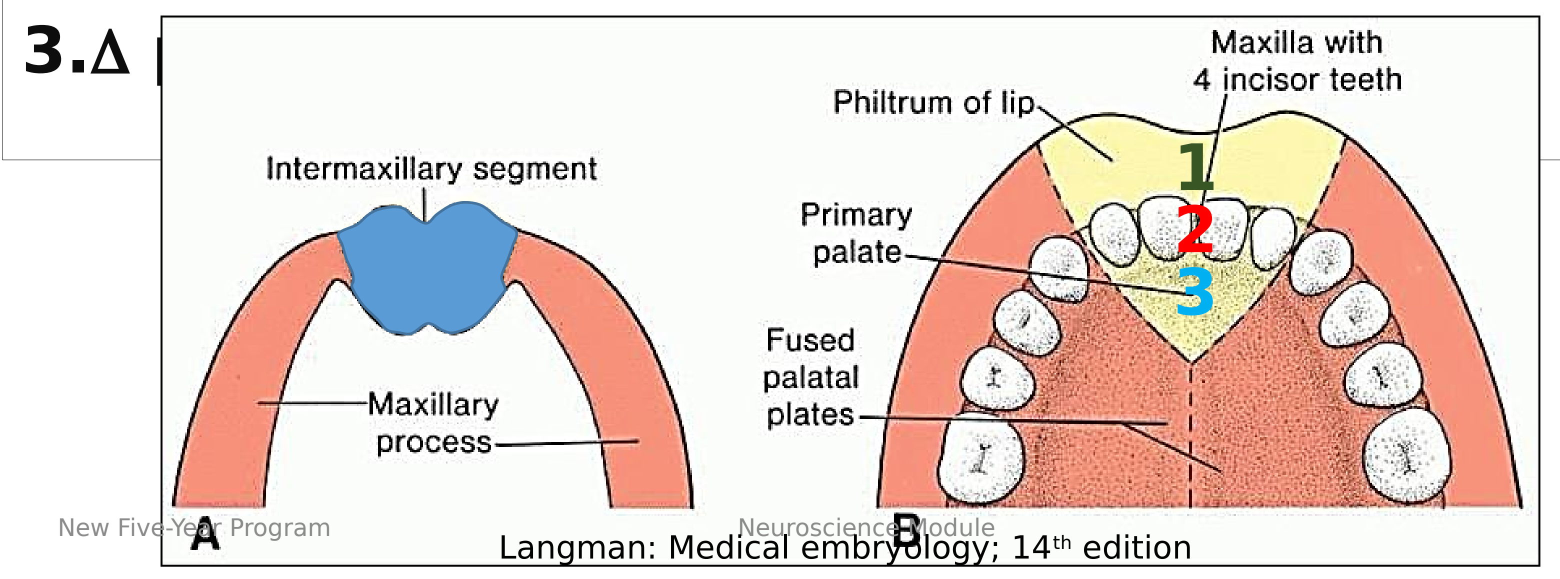
.Merging of <u>medial nasal</u> & <u>maxillary</u> prominences ⇒ Continuity of the upper jaw & lip and separation of the nasal pits from the stomodeum.

♣Intermaxillary segment (<u>Median nasal prominence</u>) gives:

1.<u>Deep</u> middle part of the upper lip.

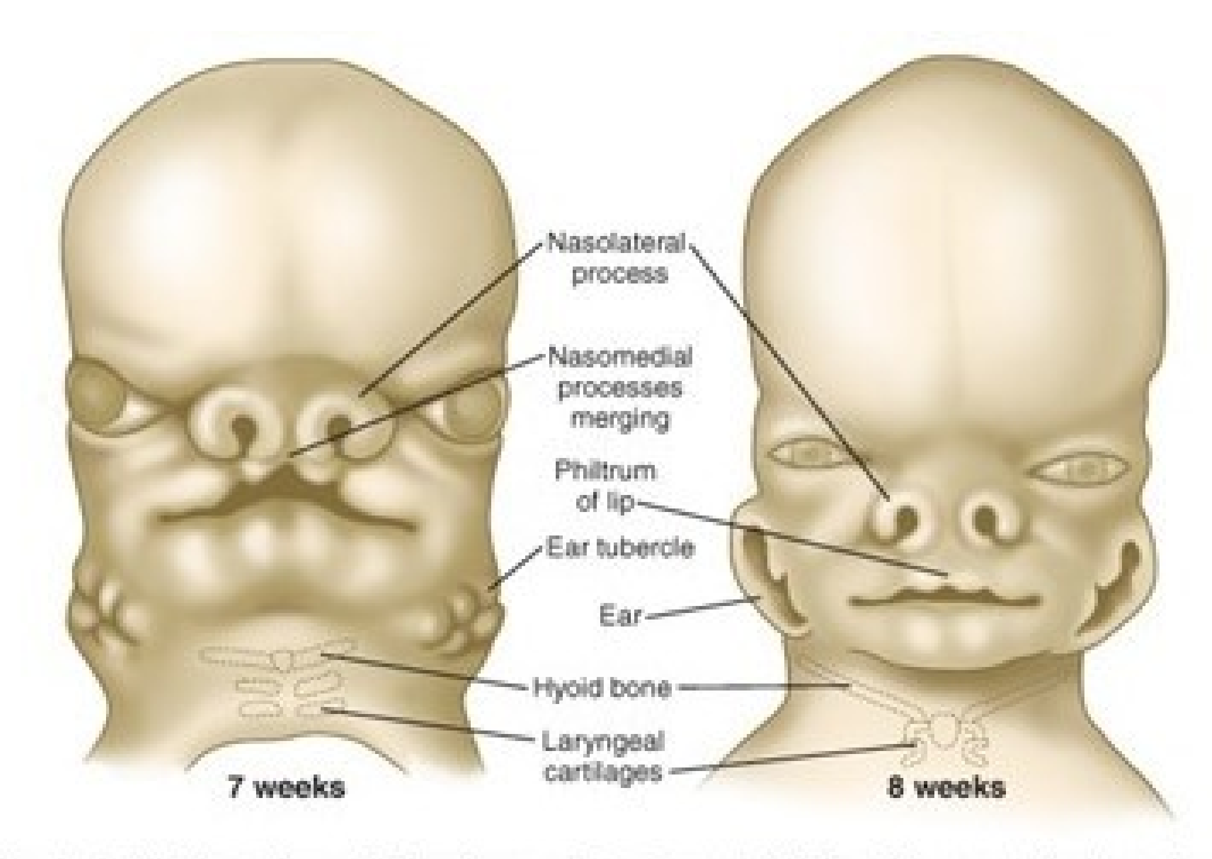
2.Premaxillary part of the upper jaw (carries upper 4 incisors) & its associated gum.

3.Δ



Langman: Medical embryology; 14th edition

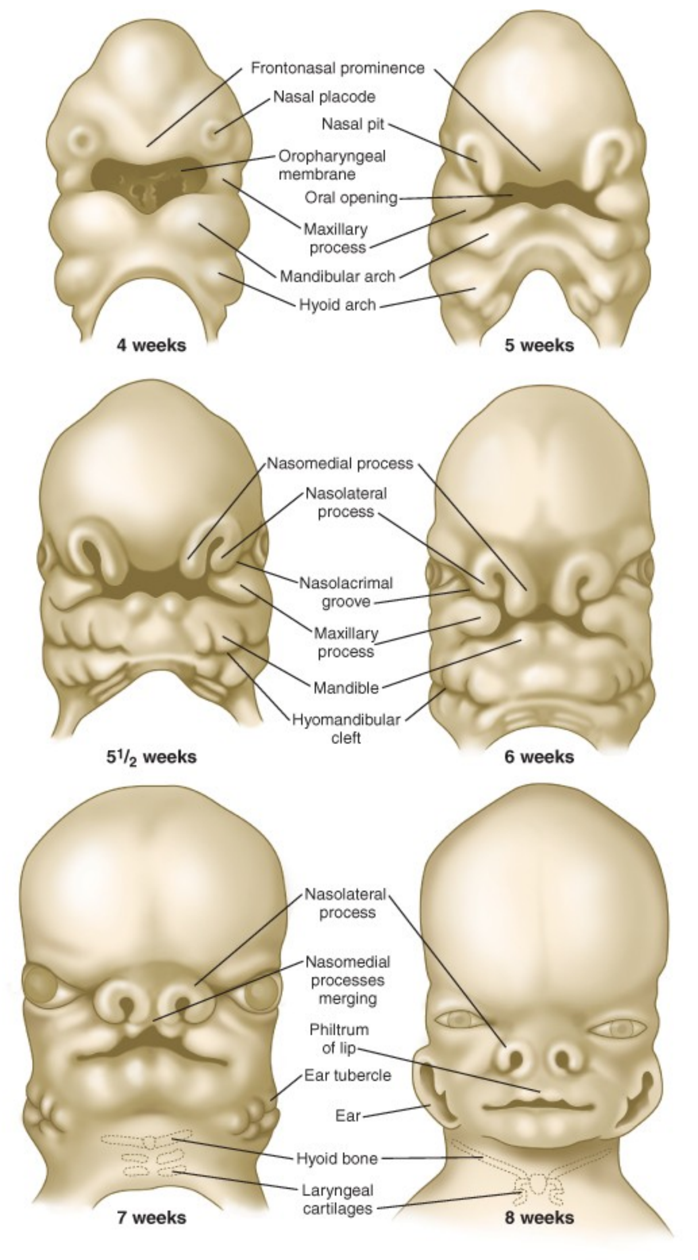
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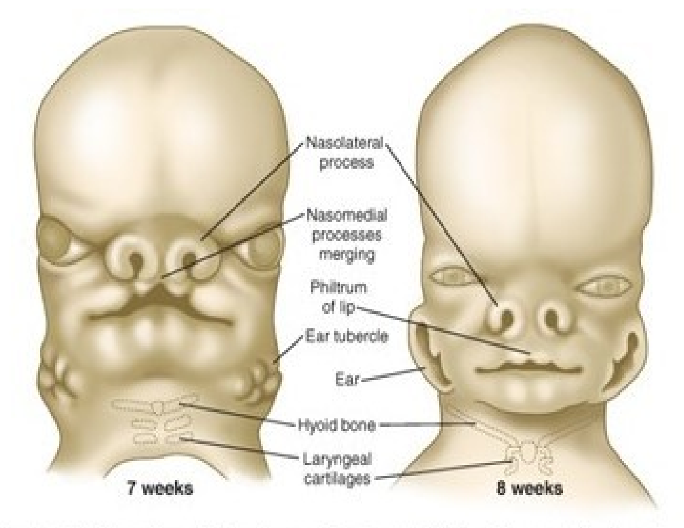
B]Changes in the maxillary prominence:

.By the end of 6th week, each maxillary prominence fuses (merges) with 3 adjacent prominences:

1.Ipsilateral lateral nasal prominence along the nasolacrimal groove.

-This establishes continuity between the side of the nose & the cheek.

The nasolacrimal duct develops from an ectodermal thickening in the floor of the nasolacrimal groove.



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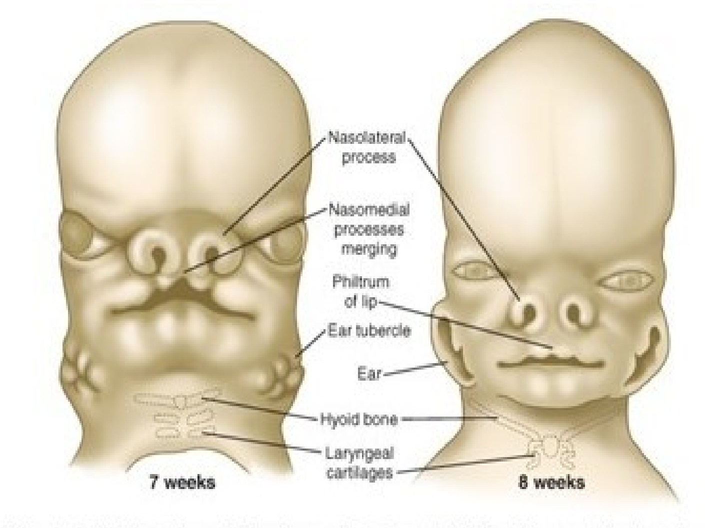
2.Ipsilateral **medial nasal prominence** & opposite **maxillary prominence** to form:

1.Upper lip (except its deep middle part).

2.Upper jaw (except its premaxilla) ⇒ Maxilla.

3.2ry palate.

.Maxillary prominences form the **philtrum** of the upper lip, while intermaxillary segment forms its deep middle part.



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3.<u>Ipsilateral</u> mandibular prominence to form the cheek & thus ↓ the width of the stomodeum.

<u>C]Changes in the mandibular prominence:</u>

.Each mandibular prominence merges with 2 adjacent prominences:

1.<u>Ipsilateral</u> maxillary prominence → Cheek.

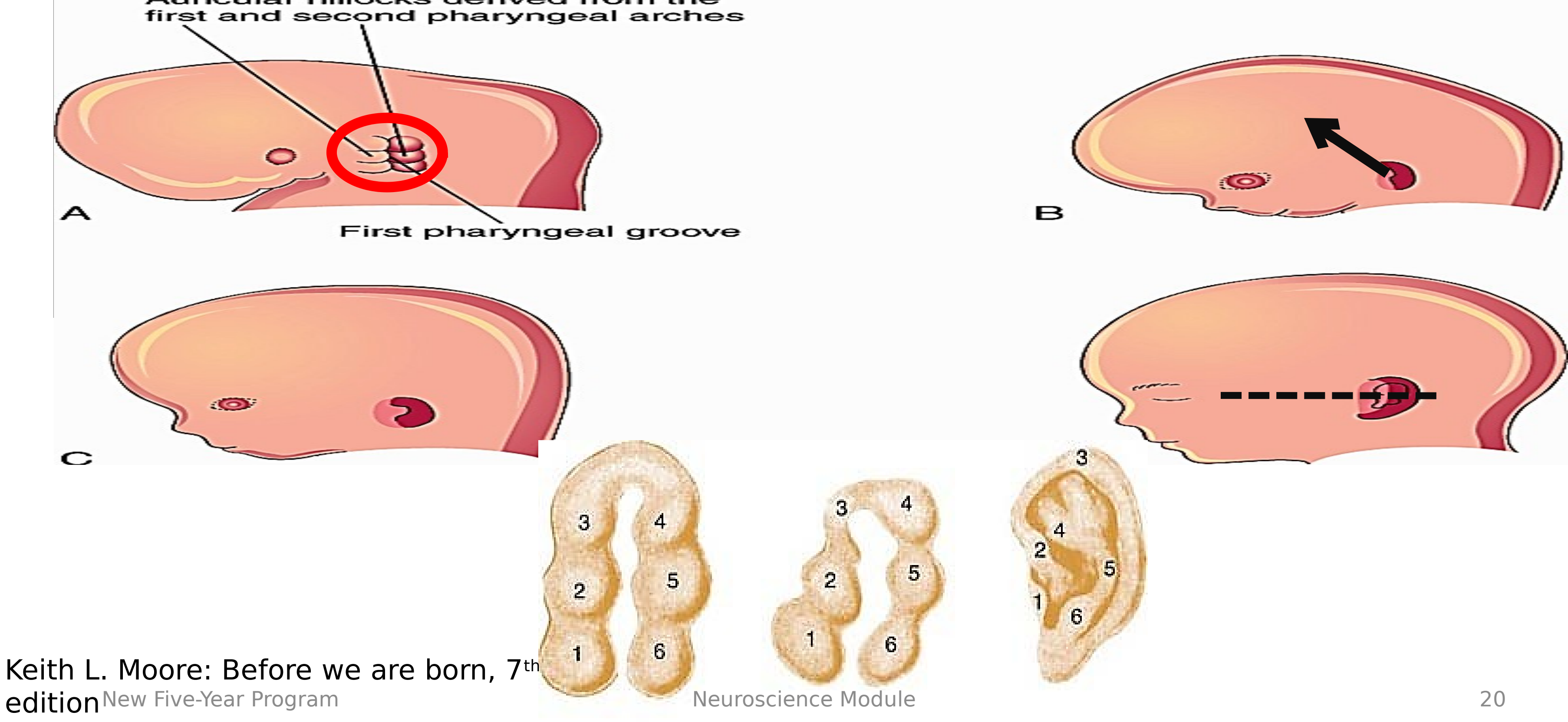
2.<u>Contralateral</u> mandibular prominence, caudal to stomodeum → Lower lip & jaw.

♣The primordial lips & cheeks are invaded by myoblasts from 2nd pharyngeal arches, which differentiate into facial muscles (innervated by <u>facial nerve</u>).

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- By the end of 5th week, 6 auricular hillocks (mesenchymal swellings) develop around 1st pharyngeal cleft (primordium of external acoustic meatus) & fuse together to form the auricle.

-Initially, the external ears are located in the neck & as the mandible develops, they ascend



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Quiz



▪Mention <u>true or false</u> for each statement regarding development of the face:

a. Facial prominences develop from neural crest cells.

b. Nasal placodes develop within maxillary prominences.

c. Both maxillary & mandibular prominences develop from 1st pharyngeal arch.

d. FNP shares in formation of intermaxillary segment.

e. Cheek develops by fusion of the 2 maxillary prominences.

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- **Unilateral harelip results from failure of fusion of:**

a.Maxillay prominence with intermaxillary segment

b.Maxillary prominence with lateral nasal prominence *

c.Maxillary prominence with mandibular prominence

d.Medial nasal process with lateral nasal process

e.Two mandibular prominences

♣**Development of the palate**:-

Palatogenesis (formation of the palate) takes place during 6th – 12th week of development

-Palate develops from 2 primordia: Primary palate & secondary palate.

■∆ primary palate (median palatine process) develops from the deep part of the intermaxillary segment ⇒ Part anterior to the incisive fossa.

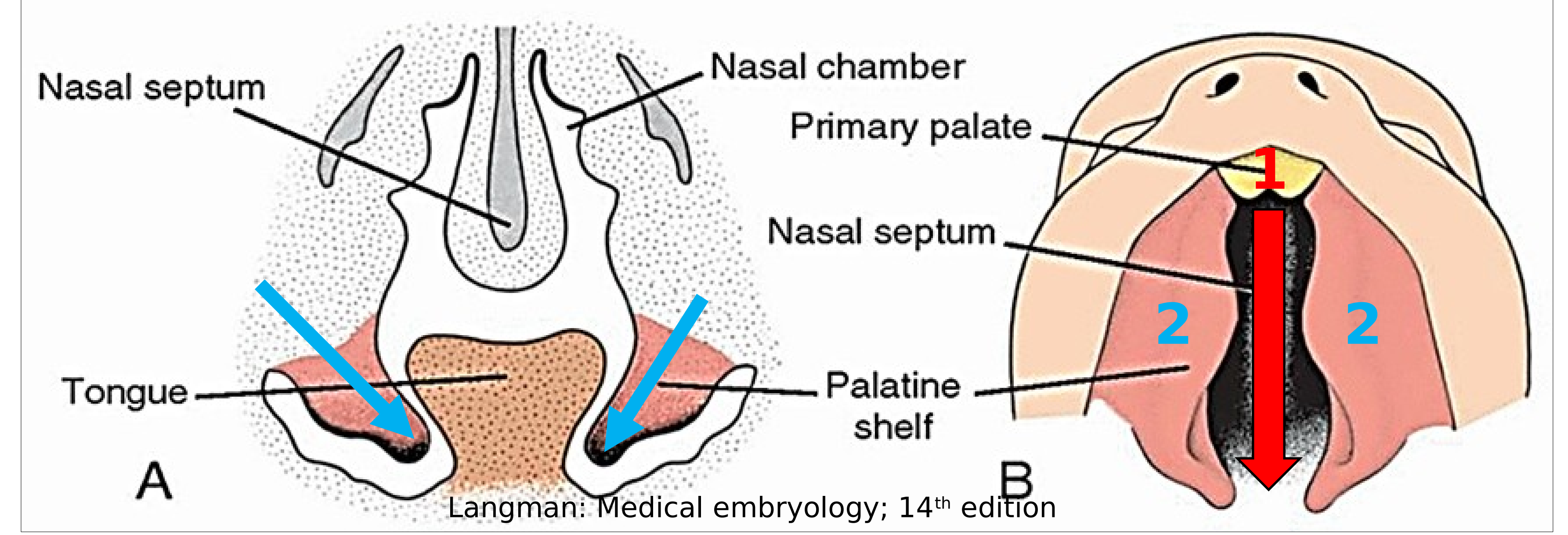
■Secondary palate:

-2 palatine processes or shelves develop as 2 shelf-like outgrowths, from the deep aspects of maxillary prominences.

-At first, they project downwards & medially and are separated from each other by the tongue.

-Later, they ascend, assuming a horizontal

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Langman: Medical embryology; 14th edition

-Palatine shelves fuse together from <u>before backwards</u>.

-They also fuse with the primary palate and the nasal septum.

-This fusion begins anteriorly during 9th week & is completed by 12th week.

-Secondary palate gives rise to posterior 2/3 of hard palate, soft palate & uvula.

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Congenital anomalies of the face

A]<u>Cleft lip (harelip)</u>:

.The clefts may be unilateral or bilateral → Abnormal facial appearance & defective speech.

.They are caused by many factors including genetic disorders, chromosomal anomalies & teratogens as anticonvulsant drugs.

●<u>Clefts of upper lip</u>: More common in <u>males</u>.

.They include:

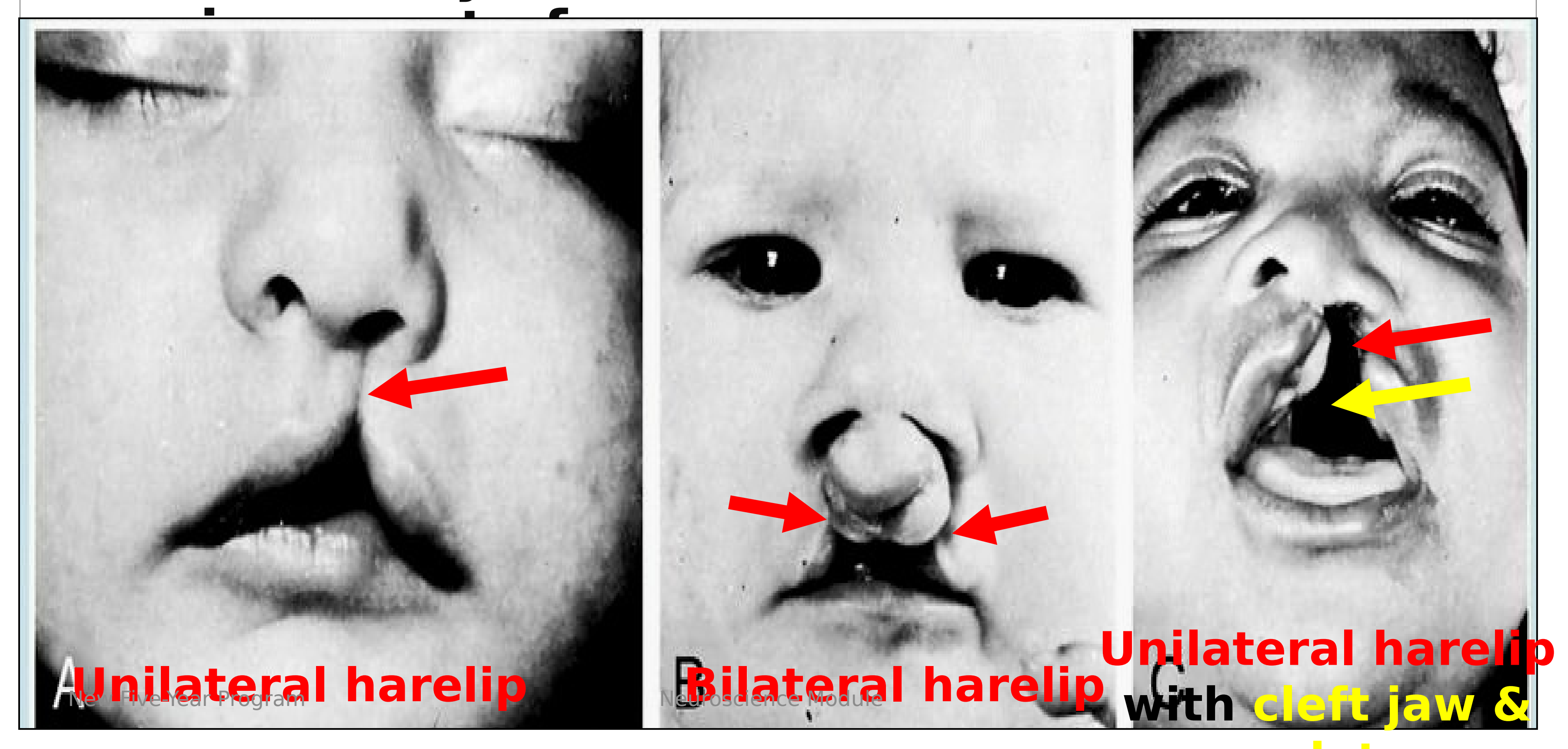
1.Unilateral cleft lip (harelip): Failure of fusion of maxillary with median nasal prominence on the affected side.

2.Bilateral cleft lip (harelip): Failure of maxillary prominences to meet & unite with

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3.Median cleft lip (harelip): This is a very rare defect, which results from partial or complete failure of the <u>2 medial nasal</u> prominences to merge & form the intermaxillary segment.

- **Median cleft lower lip: This is also very rare & is caused by failure of the 2 mandibular**



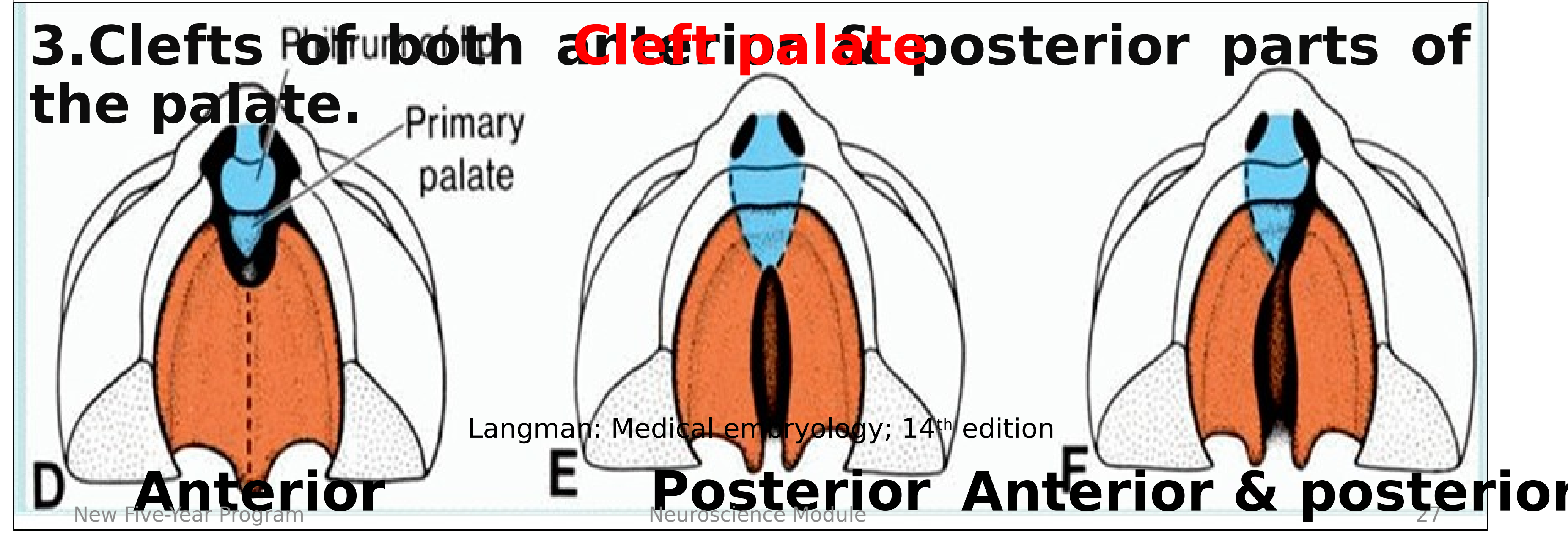
B]Cleft palate: More common in females.

.3 groups:

1.Clefts of anterior palate result from failure of fusion of palatine shelves with Δ primary palate.

2.Clefts of posterior palate result from failure of fusion of palatine shelves with each other & with the nasal septum.

3.Clefts of both anterior & posterior parts of the palate.

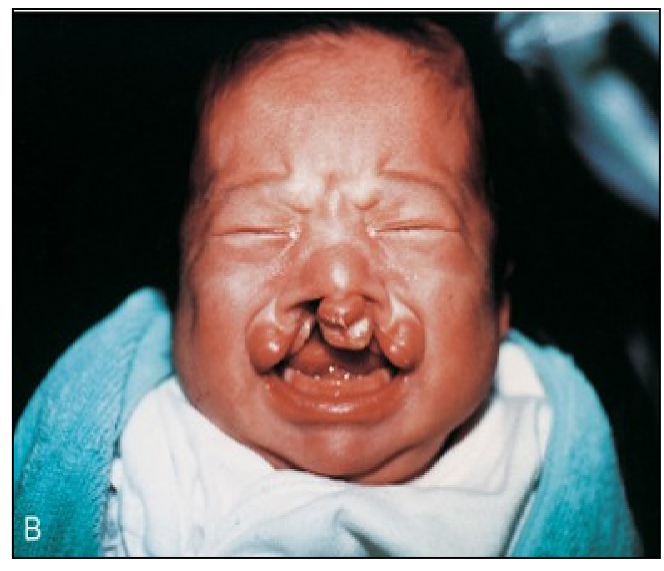


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Clefts of the upper lip & palate



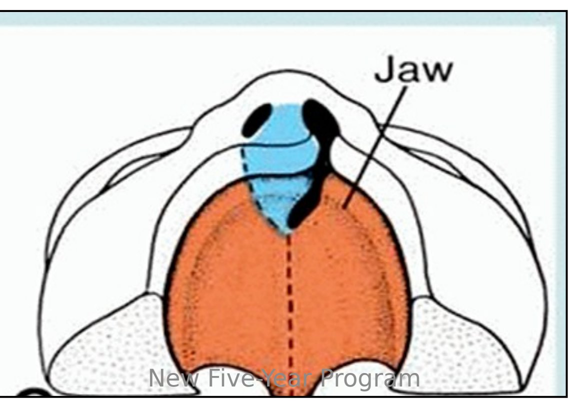


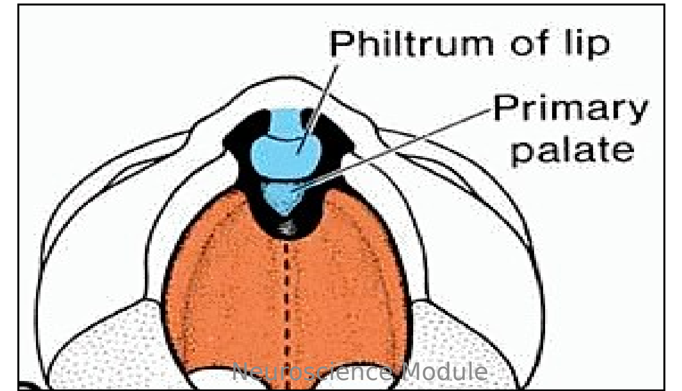


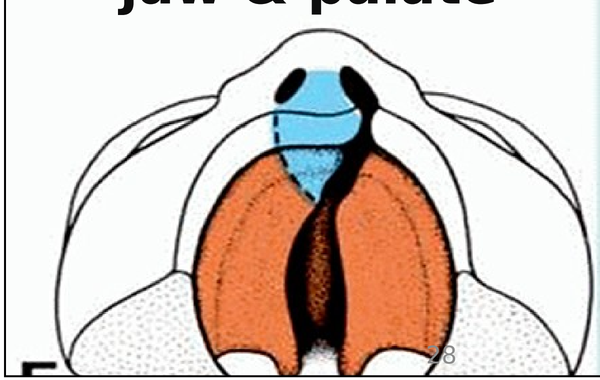
lateral cleft lip & palate

Bilateral cleft lip & palate

Unilateral cleft lip, jaw & palate







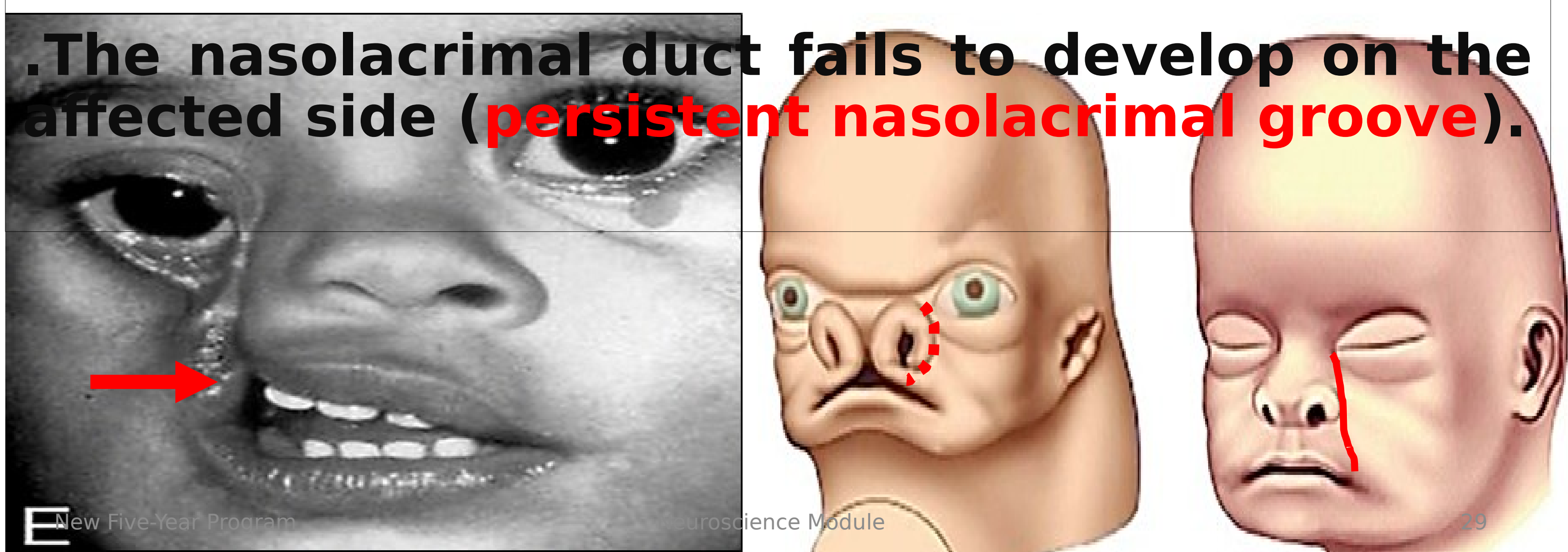
Langman: Medical embryology; 14th edition

C]Oblique facial cleft (orbito-facial fissure): **Rare condition which may be unilateral or bilateral.** ***Along nasolacrimal groove***

-The cleft extends from upper lip to medial margin of the orbit.

-It results from failure of fusion of maxillary prominence with lateral nasal prominence on one or both sides.

.The nasolacrimal duct fails to develop on the affected side (persistent nasolacrimal groove).



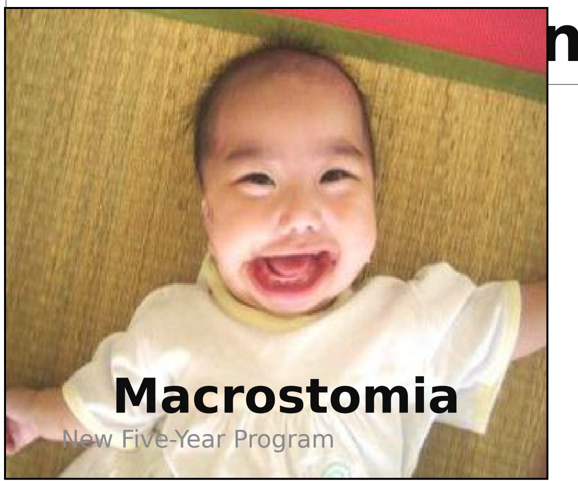
D]Other facial anomalies:

1.**Macrostomia**: Wide mouth opening due to underfusion of the maxillary & mandibular prominences of 1st arch.

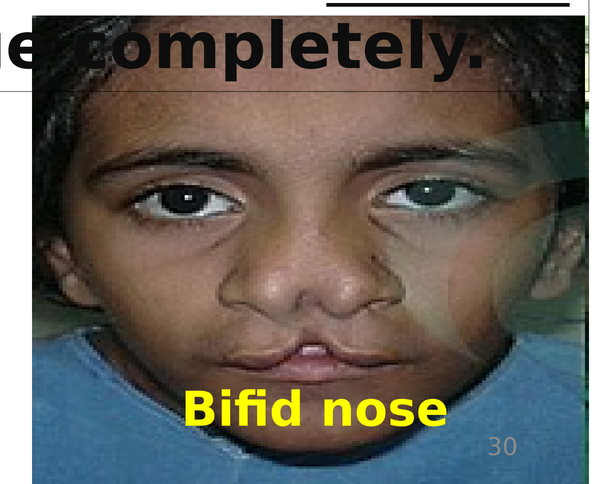
2.**Microstomia**: An abnormally small mouth opening due to excessive merging of the maxillary & mandibular prominences.

3.**Absence of the nose**: A very rare condition which occurs when no nasal placodes form.

4.**Bifid nose**: This results when the medial n… …ge completely.


Macrostomia


Microstomia


Bifid nose

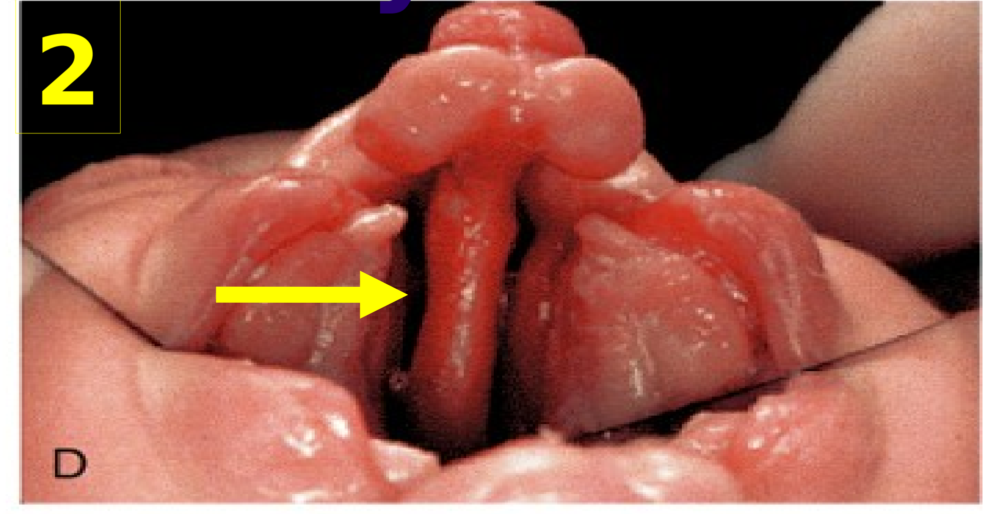
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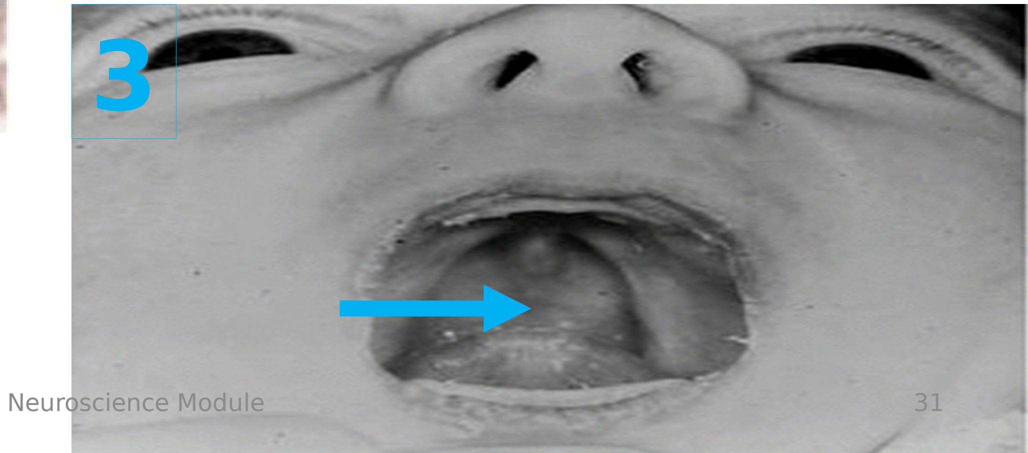


Quiz

Identify the anomaly







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Lecture Summary





Facial prominences or primordia

-There are 5 facial prominences or primordia: FNP, 2 Maxillary & 2 mandibular induced by neural crest cells

-FNP forms the forehead & the rostral (cranial) boundary of the stomodeum & the nose.

-Maxillary prominences form the lateral boundaries of the stomodeum.

-Mandibular prominences constitute the caudal boundary of the stomodeum.

-Lower jaw & lower lip are the first parts of the face to form

Palate develops from 2 primordia; Primary & secondary palate during 6th – 12th week of development (Palatogenesis)

Remember congenital anomalies of the face (e.g. clefts) & their explanation. *Very important*

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SUGGESTED TEXTBOOKS



1. **Keith L. Moore: Before we are born, essentials of embryology and birth defects; 7th edition.**
2. **Langman: Medical embryology; 14th edition.**
3. **Web sites: https://studentconsult.inkling.com**
   https://www.clinicalkey.com/student



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